MULTIMEDIA UNIVERSITY

STUDENT ID NO

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# MULTIMEDIA UNIVERSITY

# FINAL EXAMINATION

**TRIMESTER 2, 2018/2019**

## DCS5028 – DISCRETE STRUCTURES

(For DIT/DBIS students only)

1 MARCH 2019
9.00 a.m. – 11.00 a.m.
( 2 Hours )

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**INSTRUCTIONS TO STUDENT**

1. This examination paper consists of **4** pages.
2. There are **5** structured questions.
3. Write all answers in the **Answer Booklet** provided.

**STRUCTURED QUESTIONS (TOTAL: 50 Marks)**
**Answer all questions and show necessary workings in the answer booklet provided.**

## QUESTION 1 (10 Marks)

A. For the following compound proposition: $(\neg p \vee \neg q) \rightarrow ((r \wedge \neg q) \leftrightarrow p)$, determine if it is a tautology, contradiction or contingency. [4 Marks]

B. State the inverse, converse and contrapositive for the following proposition:
"If I am a Malaysian, then I am Asian."
[3 Marks]

C. Given $X = \{x \mid 0 < x < 35\}$ and $Y = \{y \mid 5 < y < 60\}$ where $f$ is a function mapping $X$ to $Y$. Let $f(5) = 30, f(10) = 20, f(15) = 10, f(20) = 50, f(25) = 40$ and $f(30) = 30$.
I. Draw its arrow diagram and find its domain and co-domain. [2 Marks]
II. Determine if it is injective, surjective and bijective. [1 Mark]

## QUESTION 2 (10 Marks)

A. Use a mathematical induction to prove that

$$S_n = 2 + 7 + 12 + \ldots + (5n - 3) = \frac{n(5n - 1)}{2}$$

is true for all positive integers. [7 Marks]

B. Consider the following function. [3 Marks]

```
int recurse (int x)
{
     if (x == 1)
         return 1;
     else
         return (5 * x) + recurse (x - 1);
}
```

Show the tracing process to derive the result by this function call: **recurse (5)**.

**Continued...**

## QUESTION 3 (10 Marks)

A. By using the Euclidean Algorithm, find :

I. Greatest Common Divisor (GCD) for the numbers of 514 and 107. [1.5 Marks]
II. The value of $s$ and $t$ satisfying that $514s + 107t = \text{GCD}(514, 107)$. [3.5 Marks]
III. Least Common Multiple (LCM) (514, 107) [1 Mark]

B. How many 3-digit numbers can be formed with the digits 5, 3, 2, 7, 9, 8 if the digits are not repeated? [1 Mark]

C. In how many ways can the letters of the word "HIPPOPOTAMUS" be arranged? [3 Marks]

## QUESTION 4 (10 Marks)

A. Find the degree of each vertex for the graph shown in **Diagram 1**. [5 Marks]

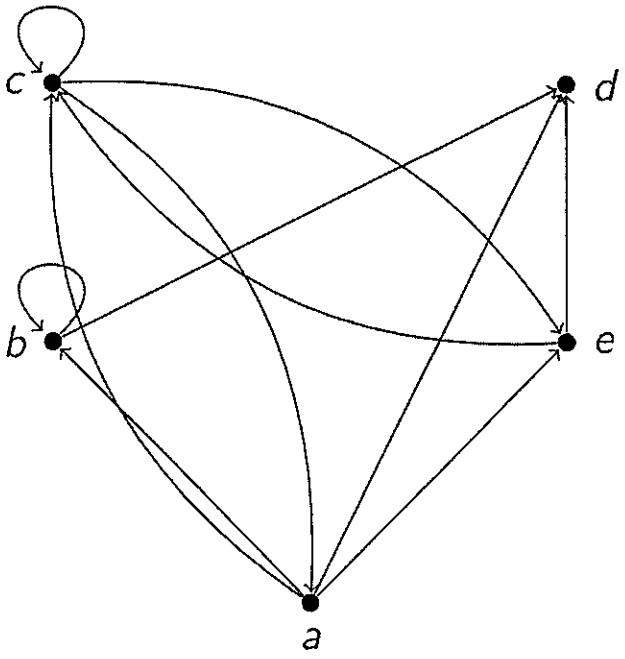



**Diagram 1**

**Continued...**

B. Given a tree diagram shown in **Diagram 2**:

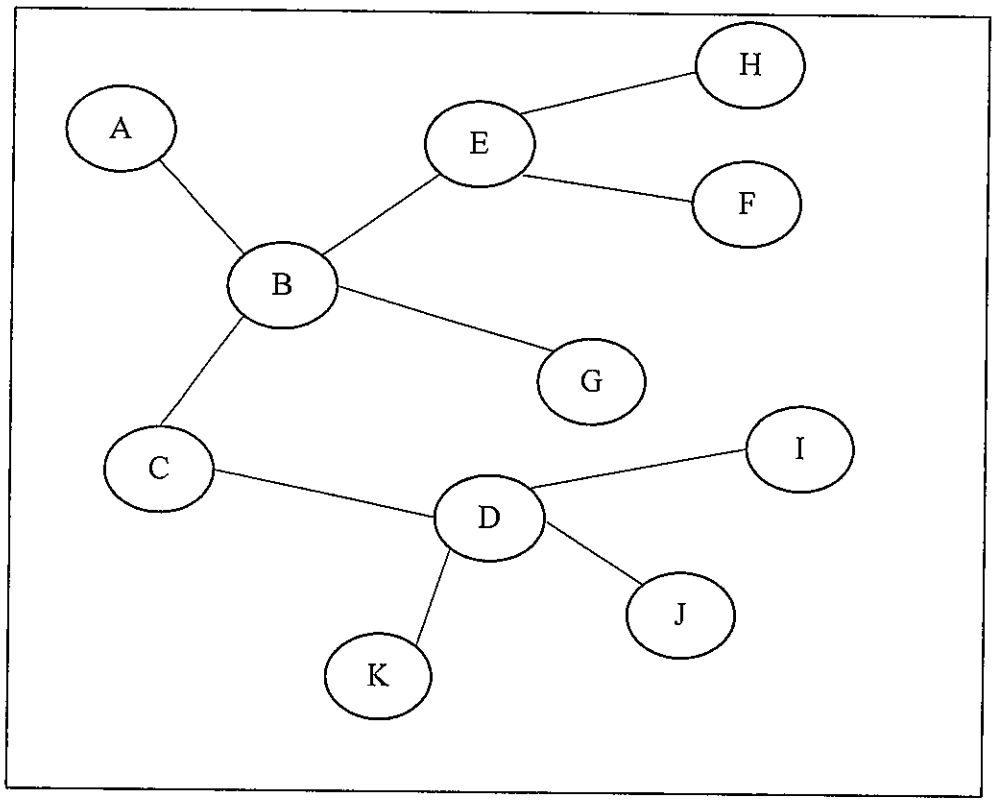



**Diagram 2**

I. Redraw the tree above with **B** as the root. [2 Marks]

II. Based on the newly constructed rooted tree in **Part (I)**, find the following:

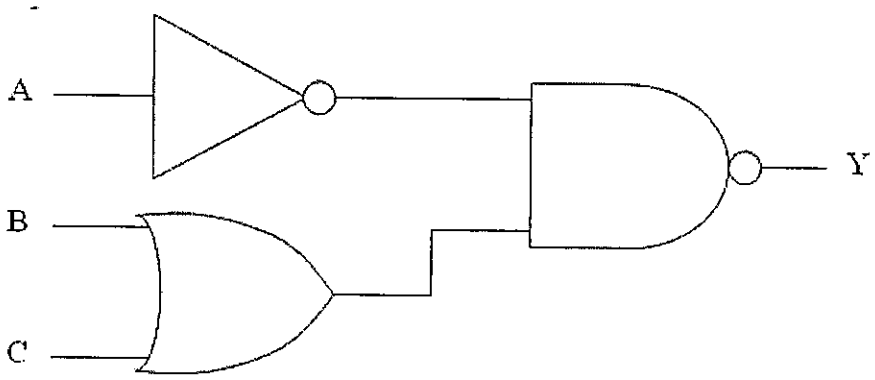
a. Parent of D. [0.5 Mark]
b. Siblings of C. [0.5 Mark]
c. Leaf nodes. [0.5 Mark]
d. Ancestors of F. [0.5 Mark]

III. Draw the sub tree rooted at **C**. [1 Mark]

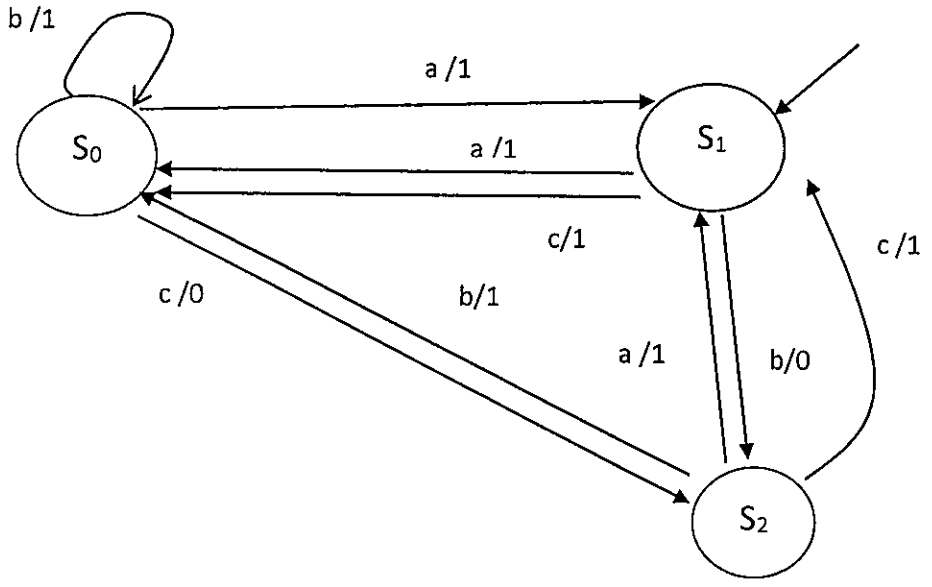
**Continued...**

## QUESTION 5 (10 Marks)

A. Write the ***logical expression*** that corresponds to following circuit and construct the ***truth table***. [6 Marks]




B. Given the following finite state machine diagram, redraw the transition diagram as the diagram of a finite state automaton. [4 Marks]

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